

API REVIEW

API's Review Shows EPA's Monitoring Wells at Pavillion, Wyoming are Improperly Constructed and Unsuitable for Groundwater Quality Assessment

Two new technical reports^{1,2}, were released by the United States Geological Survey (USGS) on September 26, 2012 regarding EPA's Pavillion, WY groundwater study and EPA's associated December, 2011 report³. These USGS reports describe the results of their April-May, 2012 testing of one of the monitoring wells (MW-01) previously sampled by EPA, and their attempts at sampling monitoring well MW-02, which was unsuccessful due to sampling issues related to well construction deficiencies. Counter to EPA findings, the USGS did find the presence of several key chemical compounds of interest, most notably glycols and 2-butoxyethanol (2-BE), previously reported to be found in both monitoring wells MW-01 and/or MW-02 by EPA. These constituents previously found by EPA were found at significant concentrations by the USGS.

API's review highlights significant concerns regarding EPA's transparency during this investigation and identifies severe and numerous monitoring well construction flaws. This leaves EPA's deep monitoring wells unsuitable to meet EPA's originally stated objective of testing for color, and taste complaints in residential wells. These are generally shallower wells located near the EPA monitoring wells. Due to the numerous deficiencies in design, construction, installation, decontamination, and development (as described below), groundwater sample analyses from these wells (MW-01 and MW-02) are unreliable since it is not possible to determine if chemicals found in the wells are due to faulty well construction or are present in local groundwater.

Specific deficiencies have been identified include:

- USGS' SAP² specified a criterion for sampling that required the pH of the groundwater to be stable for sampling. A review of the USGS data presented in their report¹ shows pH stabilization did not occur during sampling, and graphs in that USGS report suggest that well MW-01 is still being impacted by high pH cement (known to contain glycols and phenols) and/or drilling fluids used by EPA. Review of all analytical and development data suggests that both monitoring wells MW-01 and MW-02 have yet to be properly developed and are both being affected by cement. USGS was unable to use standard USGS and best practice sampling/purging methods for monitoring well MW-02 due to completion and development problems encountered during the April-May, 2012 USGS investigation. In spite of USGS's valid concerns, EPA collected a sample of groundwater from MW-02 for analysis. Further, USGS appears to have revised their SAP² following completion of their April-May, 2012 sampling activities, which is highly unusual. It is recommended that all revisions of the USGS SAP be provided to the public.
- Another critical deficiency in the construction of these wells is the fact that EPA failed to use a bentonite annular seal above the well screen and sand pack which ensures that cements used as annular sealants above this bentonite plug do not move down into the well screen and adjacent

formation interval and affect groundwater quality results. The lack of this bentonite seal likely allowed cements to move down into the well screen and formation interval in both wells. EPA or state agencies typically do not accept results from monitoring wells lacking effective seals.

- USGS noted in their Sampling and Analysis Plan (SAP)², but not in their Data Series Report¹, that a 4-inch *"threaded and coupled, black painted/coated carbon steel casing"* was used as riser pipe by the EPA in the construction of monitoring wells MW-01 and MW-02. Paint can contain a wide variety of organic and inorganic compounds, including 2-BE, a very common component of many coatings. The well construction diagrams and associated descriptions provided in the EPA 2011 Draft Report³ inaccurately represent this 4-inch casing as stainless steel. Further, pictures provided in the EPA 2011 Draft Report³ show what appears to be a blue-painted sand/basket that fieldnotes suggest was welded to the top of the screen in both wells, again bringing paint and welding compounds into contact with groundwater. This sand/grout was also lined with some type of black material, and the type and composition of the black liner material used should be disclosed. It is not sound scientific practice to use painted/coated casing or other chemicals containing materials in any environmental monitoring well completion because compounds in the paint/coating or other materials can contaminate groundwater samples collected from the well. EPA recently released (September 6, 2012) new well construction diagrams on their Pavillion website for monitoring wells MW-01 and MW-02 that corrected numerous inaccuracies and misrepresentations presented in their 2011 Draft Report, but these new diagrams do not include or point out the use of black painted/coated casing or the painted sand basket.

- EPA did not disclose within its 2011 Draft Report³ a landowner complaint related to an alleged release of anti-freeze (which contains glycols) and cement in the vicinity of monitoring well MW-01, and details regarding any associated cleanup activities. The driller's fieldnotes⁴ from August 17, 2010 state: *"Site cleanup and investigation on anitfreeez [sic: antifreeze] and cement acuazations [sic: accusations] from property owner."* EPA's fieldnotes and reporting of this incident are inadequate given the importance of quality assurance to this project. There appears to be EPA contractor and/or driller fieldnotes omissions surrounding the alleged release/cleanup dates (i.e. August 17, 19, and 21, 2010). All fieldnotes maintained by the drilling contractor and any of EPA onsite contractors should be disclosed and made publically available if they exist. EPA's field notes and reporting of this incident are inadequate given the importance of quality assurance on this project.
- Commercial rental air compressors appear to have been used for development of both wells by EPA. When monitoring groundwater for hydrocarbons, it is important that hydrocarbon filters be incorporated into the compressed air stream to ensure compressor hydraulic oils are not introduced into the groundwater being investigated. There is no mention of hydrocarbon filters being utilized during the EPA Pavillion study. Lack of filters would likely lead to false hydrocarbon related results. The compound 2-BE is also found in many cutting and hydraulic oils. EPA should disclose and provide documentation that hydrocarbon filters were indeed used during drilling and well development.

- EPA's 2011 Draft Report discusses 7 of 10 additives used during drilling and installation of monitoring wells MW-01 and MW-02. Out of the 10 additives, organic analyses were only conducted on 3 additive products (but not the cements or lubricant). All materials and additives used down hole should have been analyzed by EPA to ensure the compounds were not incorrectly attributed to another source. For example, commercial grade cements used by EPA are widely known to contain glycols, particularly diethylene glycol, and possibly phenols. Key EPA laboratory analytical reports for 2-BE, diethylene glycol, and ethylene glycol for these additives appear to be missing from the EPA Pavillion website and should be provided for public review.
- EPA's 2011 Draft Report states *"There were no incidents of fuel spillage used to power pumps and generators."* Field notes collected by EPA's contractor suggest that there in fact was fuel loss at the site (MW-02 location) on July 14, 2010: *"diesel fuel lost from loose [] repaired."* The details surrounding this diesel fuel loss should be disclosed and further investigated.
- EPA's *"Final Monitoring Well Installation Work Plan, Pavillion, Wyoming, 2010"*⁵ outlined decontamination procedures that were to be followed by the Work Plan. Appropriately required *"[] well completion materials shall be contaminated by steam (not water-phosphorous) if solids, oil, or grease are present. Pipes shall be rinsed prior to installation."* EPA contractor field notes⁶ for MW-01 indicate these decontamination procedures were not followed. *"[] began decontamination for well. Stack washer on plastic and covered. [] decontamination pipes not performed (pressure washer, soap). Pipes [] cap on ends. Road dust washed from pipes. [] visual signs of O/G. The EPA driller's notes⁷ reinforce the fact: "...was 4" in well casing with garden hose and covered with plastic."* EPA in its 2011 Draft Report appears to intentionally provide inaccurate and misleading information regarding the use of decontamination procedures for well construction equipment: *"Well Screens, sections of casing and tremie pipe were mounted above ground (never touched soil) and power washed (no detergents used) prior to deployment."* Milling and cutting oils on this type of casing are very common and may contain 2-BE and hydrocarbons, leading to sample contamination if not removed during decontamination procedures.
- USGS did not provide substantial technical interpretation of their April 2012 data, but rather was requested by a cooperative agreement with Wyoming⁸ to provide those results to the panel tasked with looking at the broader EPA study.
- USGS² appropriately elected to not employ "swabbing" well development techniques across the screen interval in MW-02 due to potential induced contamination stemming from leaching of chemicals from the rubber swab stating that: *"Did not run block inside well screen as the screen's internal ribs would have cut the rubber block rendering it useless and leaving rubber material in the bottom of the well."* EPA apparently did not acknowledge those concerns and extensively swabbed the screen intervals in both wells, potentially cross contaminating the groundwater in both wells.
- Centralizers do not appear to have been extensively used (if at all) in the construction of the monitoring wells. Centralizers position the riser pipe centrally in the borehole to ensure uniform and even placement of grout between the casing and borehole wall. Poor annular seal can result in groundwater entering the well (or moving into other zones) at depths other than the screened interval.

CONCLUSION

Based on the information identified within this document, as well as previously identified issues⁹, API has determined that the EPA monitoring wells drilled at Pavillion are unsuitable to meet EPA's (or any groundwater quality) monitoring objectives. All groundwater sample analyses from these wells should be considered unreliable in the context of the information presented here prior to developing conclusions or use in decision making. These wells are unsuitable for assessment of groundwater quality and the results from analysis of any samples (past and future) from these wells are invalid and should never be used in technical evaluations. There is no scientific basis for continuing reviews and discussions of any such results and the EPA wells should be properly plugged and abandoned. The lack of sound scientific principles, practice, standards, and guidance for monitoring these well installations, as well as misrepresentations or omissions of information related to EPA's deep monitoring wells, raise significant questions, not only on this project, but EPA's ongoing efforts related to evaluation of hydraulic fracturing. API supports scientifically credible studies and will continue to evaluate the credibility of scientific assessments regarding onshore unconventional oil and gas exploration to ensure the information utilized in policy decision making is accurate.

¹ "Groundwater-Quality and Quality-Control Data for Two Monitoring Wells near Pavillion, Wyoming, April and May, 2012", USGS Data Series Report 718, 2012.

² "Sampling and Analysis Plan for the Characterization of Groundwater Quality in Two Monitoring Wells near Pavillion, Wyoming", USGS Open-File Report 2012-1197.

³ "Investigation of Ground Water Contamination near Pavillion, Wyoming", EPA 600R-00/000, December 2011

⁴ <http://ftp.epa.gov/r8/pavilliondocs/WellDrillingInformation/DrillingLogsAndCuttingsDescription/DailyLogsFromDrillersJunSep2010.pdf>

⁵ Final Monitoring Well Installation Work Plan Pavillion Wyoming, USEPA, May 2010

⁶ <http://ftp.epa.gov/r8/pavilliondocs/WellDrillingInformation/DrillingLogsAndCuttingsDescription/FieldActivityLogD.pdf>

⁷ <http://ftp.epa.gov/r8/pavilliondocs/WellDrillingInformation/DrillingLogsAndCuttingsDescription/DailyLogsFromDrillersJunSep2010.pdf>

⁸ <http://www.usgs.gov/newsroom/article.asp?ID=3410>

⁹ Review of U.S. EPA's December 2011 Draft Report, "Investigation of Groundwater Contamination near Pavillion, Wyoming, April 26, 2012, S.S. Papadopoulos and Associates, Inc.